SCHOOL OF
Graduate Studies

Concordia
UNIVERSITY

Graduate Studies News

Volume 8, no. 3 October 1995

Biology at Concordia: Our Best Kept Secret

by E. Tina Crossfield

Practically every day of the week, **Ian Ferguson**, one of four students in Concordia's new Ph.D. programme in Biology, can be found huddled over his collection of Water Striders. His "mark and recapture" study on these aquatic insects regularly takes him from field work at McGill's Mount St. Hilaire Research Station to the laboratory bench in what might be called the best of both worlds. Under the guidance of **Dr. Daphne Fairbairn**, an evolutionary biologist who supervises graduate students in Ecology and Behaviour, Ian hopes to generate a long term study of these creatures in order "not to miss the true picture." He insists that field work and lab study are complementary activities which can lead to new insights about restricted habitats, localized species, and the evolutionary forces governing survival and reproduction. A former Concordia master's student who recently transferred to the new Ph.D., Ian hopes to centre his career in education.

Indeed, the emphasis on education, formalized training, and communication skills is what continues to set Biology at Concordia University apart from other Montreal institutions. Inaugurated in the fall of 1994, the Ph.D. programme was a large undertaking which took approximately eight years to develop. A dedicated committee of faculty members and student representatives struggled through two levels of process within the university and the Ministry of Education, where priorities centred on funding for equipment, new faculty positions, and teaching assistantships for graduate students.

Dr. Narinder Kapoor is a physiologist who has won many awards for his outstanding electron micrographs of stonefly nymph morphology (*Thursday Report, Spring 1990-91*). In his role as Graduate Programme Director, he is responsible for overseeing the implementation of the new Ph.D. programme.

According to Dr. Kapoor, students wishing to pursue graduate work in biology prior to 1994 were first hosted by biochemistry, and then by the School of Graduate Studies' *Special Individualized Programme*, or S.I.P. Approximately ten candidates have been awarded Ph.D.s under

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this system, all of whom were supported by scholarships and/or external funding. While this arrangement worked well in the past, everyone involved was convinced that the time had come for Biology to recognize the emerging research nature and academic maturity of the department.

The Biology Department already had much to offer. Its solid undergraduate programme has maintained more than five-hundred students per year, where even the most basic of courses are taught by faculty members with diverse interests and strong research backgrounds. Class enrolment at the introductory level rarely exceeds 150 students in any given session (compared to triple that amount at larger institutions), while numbers hover around thirty or less for 300-400 level courses.

Molecular biologist, **Dr. Claire Cupples**, feels that "increased access to professors provides the individual attention, supervision, and training that is often lacking elsewhere. There is greater interaction between students, and less competition for common space and new technologies," some of the benefits of a smaller university. A welcoming atmosphere is maintained at the front desk where Graduate Programme Secretary, **Leonie Morris**, helps keep everyone organized.

In an effort to provide graduates with 'tools' rather than additional academic work, Dr. Kapoor coordinates a compulsory course in Pedagogical Training for Ph.D.s. This exposes students to different teaching methodologies, and helps them upgrade their scientific writing and presentation skills. The department has prior experience of this kind, having offered graduate courses for high school teachers of biology in past years. In the new programme, every Ph.D. student must give four undergraduate lectures (two introductory and two advanced).

In return, the Biology Department provides financial assistance for up to three years in the form of teaching assistantships. Additional funding from outside agencies is often needed in order to support their work and ensure them a living wage. In most cases, this means that faculty need to be successful in attracting funds from granting agencies such as the Natural Sciences and Engineering Research Council (NSERC) and other major organizations.

For students like **Jeff Reeve**, **Wei Shen**, and **Hubert Gagnon**, whose work demands more rigid experimental controls and benchtop precision, the department has an impressive array of facilities. These include a greenhouse, animal rooms, photographic darkrooms, coldroom storage, a climate-controlled room, and a radioisotope laboratory.

Instrumentation ranges from the usual assortment of centrifuges and spectrophotometers to very sophisticated biochemical apparatus. A scanning electron

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Graduate students Gina Gentile and Ian Ferguson collecting water striders at Mount St. Hilaire.

microscope (SEM) is a great asset for those doing structural physiology. Jeff completed his M.Sc. at Concordia and is now a Ph.D. candidate with Dr. Fairbairn. Their research on the evolution of sexual size dimorphism by artificial selection, or the differences in body size between males and females, is carried out under laboratory conditions on the *Drosophila* genus, or fruit fly. These insects reproduce with incredible speed and have long been the staple of evolutionary and genetic research.

For Wei Shen and Hubert Gagnon, both masters' degree holders at Concordia, the transition from the S.I.P. Programme into the new Ph.D in Biology last fall was a smooth one. Both students are working in plant biochemistry and biotechnology. Supervised by molecular biologist, **Dr. Patrick Gulick**, Wei Shen is working on salt stress-induced genes, or the ability of plants to tolerate salt in the environment. Their research, carried out on cereal crops and hardy wild plants, such as tall wheatgrass, may eventually allow certain varieties of wheat to grow in marginal soils through genetic modification. Wei Shen's former experience as a research assistant in transmolecular genetics in China should enable him to complete his Ph.D at Concordia within three years and go on to fulfill his goal of working in industry.

In the adjacent lab, **Dr. Ragai Ibrahim** directs Hubert Gagnon's project which focuses on plant enzymes involved in secondary metabolism. Having selected certain species in the *Leguminasae* family, Dr. Ibrahim and his research group have identified 150 flavonoid compounds which are believed to have antifungal activity in plant tissues. Their research is basic to understanding the mechanisms of environmental stress tolerance and disease resistance, topics which are important to crop agriculture.

Currently, there are thirty-six master's and four Ph.D students, with twenty-five faculty members spread over six research areas: ecology/behaviour, animal physiology, aquatic toxicology, cell biology/biochemistry, microbiology/molecular biology, and plant/biochemistry and biotechnology. The Department has active researchers in diverse areas of biology from molecular genetics to community ecology, studying organisms, as disparate as intestinal bacteria and salmon. Students may work at the level of the molecule, cell, organism, or

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ecosystem, and may ask questions from both mechanistic and evolutionary perspectives.

Several faculty members are cross-listed with other departments such as Chemistry/Biochemistry, Psychology, and Geography, which allows them to supervise students in either discipline according to their interests and abilities. Students may also obtain a Diploma in Ecotoxicology, a jointly managed programme between Biology and Chemistry/ Biochemistry. All graduate students and faculty are encouraged to attend the departmental seminars, where visiting faculty from around the world are also invited to speak about their research. This wider exposure to other scientists and their research is of great benefit to everyone, but especially to those just starting out.

While prospective Ph.D. candidates must have a master's degree prior to submitting their applications, Concordia's M.Sc. in Biology is already a research based degree. With an emphasis on training, only nine out of forty-five credits are derived from courses. The remainder are distributed between a thesis, an oral exam, regular attendance and participation in seminars, and overall performance in the lab. If they wish, excellent students have the option of transferring to the Ph.D. after their master's courses are completed, but before their theses progress too far. Switching mid-stream is not automatic, however, and students must be highly recommended by their supervisor and from within the department.

Because graduate students at Concordia are true research apprentices, they are expected to spend as much time working in the lab as possible. In fact, most spend up to twelve hours per day scanning the scientific literature, conducting experiments, and pondering their results. According to Dr. Fairbairn, "running a lab is like a small business. You are trouble-shooting everyday. Along with the financial aspect, you are a mentor and a source of information for your students. Someone who needs to be available for them on a daily basis."

A former graduate student from Queen's, **Gina Gentile**, who came to work with Dr. Fairbairn for the summer as a technician, has now moved into the master's programme. Other students, like **Ehab Abouheif**, who has almost completed his degree, has been accepted into a Ph.D. at Stonybrook, a prestigious centre at the State University of New York known for ecology and evolution. Enthusiastic about his Concordia background and career prospects, Ehab feels that science education "depends on what you make of it."

In the microbiology and molecular biology group, **Dr. Claire Cupples** studies the *Escherichia coli* bacteria and its efficiency in repairing mutations within its DNA. The genetic sequences under investigation are similar to what happens in human DNA repair, making her study a valuable

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contribution to cancer research. She welcomes the new changes in the department as a sign of growth and prosperity. "The Ph.D. will improve our visibility within Concordia and increase our scientific credibility in the larger community. It will also help improve research output and add continuity." As more people join the department, whether students or new faculty members, collaborations both formal and informal are bound to increase. Many researchers hope that additional funding for projects follow.

While the overall goal of the new Ph.D programme is to maintain ten to fifteen students in any given year, it will take time for that growth to happen. The science profession demands a long formal training for which more jobs and positions will become available in seven to ten years, about the same time it takes to train a graduate student to the post doctoral level. The reputation which the Department and faculty have built up over the years will play an important role in attracting excellent doctoral candidates. For instance, in 1993 **Dr. Elaine Newman** was awarded a prestigious Killam Fellowship by the Canada Council. The fellowship allowed her to devote herself exclusively to her chosen speciality of leucine research for two years.

Dr. Robert Roy, Chair of Biology, is completely devoting his efforts to managing the daily needs of the Biology Department which demand his full attention. He regularly confronts ethical, legal, and financial questions which arise, and strives to ensure the safety and well-being of those under his jurisdiction. This often necessitates dealing with people from other universities, the government, media, corporations, and private consultants, a job which requires strong communication and management skills as well as an intimate understanding of each faculty member's work.

His experience as a cell biologist, now administrator, has reinforced the necessity of providing graduate students with sound pedagogical training. Whether standing in front of a classroom, manipulating cells under a fume hood, or serving on an environmental review panel, there will come a time in every person's career when she/he will need to interact with a non-scientific public. Dr. Fairbairn heartily agrees. No matter what the context, "you have to be able to talk to people about your science."

On location at their research site at Mount St. Hilaire, Ian Ferguson and Gina Gentile gently scoop Water Striders into nylon nets. The warm August sun filters through a mixed hardwood canopy, dappling the stream underfoot. They are searching for insects which were caught in April, then measured, photographed, and numbered with coloured paint. At the beginning of the season, their goal was not just to catch selected insects, but every individual they saw, releasing them unharmed in the hope of recapturing them later on. Their study represents hours of

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painstaking labour, for which an even greater period of data analysis will follow back at the lab. What readily becomes apparent is the care and attention to detail which the two student biologists exhibit. Ian's remarks speak more about science in general then he realizes: "Every water strider we catch is carefully handled, labelled, and loved." His enthusiasm is contagious.

It is imperative that graduates are taught, not only how to survive in the competitive world of science and technology, but how to translate that knowledge and excitement to others. Biology at Concordia goes to great lengths to provide students with both, making it an education which is second to none.

For further information, please contact:

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UPCOMING DOCTORAL EXAMINATIONS

AGARWAL, Rajeev
Electrical & Computer Engineering
DATE: Friday, October 20, 1995
TIME: 1:30 p.m.
ROOM: GM 905-17
TITLE: *Enhancement Techniques of Short-Duration Narrowband Signals with Application to ABR Audiometry*

SCHLIECKER, Evelyn
Psychology
DATE: Friday, October 20, 1995
TIME: 4:00 p.m
ROOM: PY 244 (Loyola Campus)
TITLE: *Weight, Eating Behaviour and Psychosocial Well-Being in Adolescent Boys and Girls*

CHALIN, Patrice
Computer Science
DATE: Monday, October 23, 1995
TIME: 2:30 p.m.

CHALIN, Patrice *(cont'd)*
ROOM: LB 922-6
TITLE: *On the Language Design and Semantic Foundation of LCL, a Larch/C Interface Specification Language*

ACHUTHAN, Ramesh
Computer Science
DATE: Friday, October 27, 1995
TIME: 2:00 p.m.
ROOM: TBA
TITLE: *A Formal Model for Object-Oriented Development of Reactive Systems*

TARPIN, Christine
Communication
DATE: Thursday, Nov. 9,1995
TIME: 10:00 a.m.
ROOM: TBA
TITLE: *Les musées Québécois: De la sauvegarde de la mémoire collective à la communication*

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Printing: Concordia Printing Services
Published by:
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